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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/030,867	04/29/2002	Masanori Kimura	81839.0105	8937

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HOGAN & HARTSON L.L.P.
1999 AVENUE OF THE STARS
SUITE 1400
LOS ANGELES, CA 90067

EXAMINER

RAO, G NAGESH

ART UNIT PAPER NUMBER

1722

DATE MAILED: 09/20/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/030,867	Applicant(s) KIMURA, MASANORI	
	Examiner G. Nagesh Rao	Art Unit 1722	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 July 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1-3 and 5 is/are allowed.
- 6) ☒ Claim(s) 4 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1) Applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn.

In view of the after final response filed on 7/3/06, the finality of the last office action is revoked and a new grounds of rejection is set forth below along with allowable subject matter.

Allowable Subject Matter

2) The following is a statement of reasons for the indication of allowable subject matter: Claim 1 which has been re-written to depend from independent claim 4 recites a critical step “... *wherein the single crystal is pulled with subsidiarily heating the crucible by the subsidiary heating means in addition to the heating by the heater surrounding the crucible for a period after a ratio of a weight of the growing crystal during the pulling of the crystal relative to a weight of raw material melt before the growing becomes 60% or more.*”

Nowhere is it found in the prior art that this critical step occurs before the growing of the raw material melt prior to 60%.

Seeing that claim 1 is indicated allowable subject matter and claims 2-3 depend from claim 1 and claim 5 depends from claim 2, claims 2-3 and 5 are also in condition for allowance.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3) Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kojima (US Patent No. 6,458,202) in view of Ito (JP 01040668) in further view of Schupp (US Patent No. 6,562,125).

Kojima 202 discloses a Cz method of pulling a single crystal silicon ingot having a uniform thermal history (See abstract). The power supplied to the side heater is maintained constant throughout the growth of the main body and end cone of the ingot. The power supplied to the bottom heater is gradually increased during the second half of the growth process. The number of defects in the ingots is decreased versus the conventional process. In col. 10 lines 15-35 it is relayed that the bottom heater is used after about 40%-60% or more of the main body has

formed. The cooling rate is described as less than 5% variable in the main body of the ingot. In col 6 lines 5-25 (see also Fig 1A) the basics of Cz pulling are described including a crucible charged with raw material, a surrounding side heater, and a pulling shaft or wire for the withdrawal of the seed crystal from the melt to form the ingot. A steel container encloses the apparatus. Bottom heaters are also provided.

4) However Kojima 202 does not describe utilization percentage of the bottom heater in terms of weight of the ingot withdrawn versus the original raw material weight. Also, heating of the raw material between pulling cycles is not detailed.

Ito 668 discloses a method for growing a semiconductor crystal by the Cz pulling method. A quartz crucible is filled with raw material and heated to form a melt. Side heaters (3) and bottom heaters (4) are used in the heating process. A seed crystal is then contacted with the melt and slowly pulled up to form a single crystal ingot. A chamber (1) surrounds the crucible and heaters. The raw materials is rapidly and effectively melted (abstract) by increasing the temperature uniformly across the crucible (Fig 3 graph where the circles are the present invention).

At the time of the invention it would have been obvious to one with ordinary skill in the art to combine the raw material melting use of the bottom heater (Ito 668) with the growth use of the bottom heater (Kojima 202) because then turn

around time between uses of the apparatus would have been reduced and more product could have been made. Ito 668 suggest that the bottom heater allows rapid and effective raw material melting.

In respect to claim 4, it would have been obvious to one of ordinary skill in the art at the time of the present invention to not allow solidification of the remaining melt between batch cycles because this would require additional heat and time to be used in re-melting the remaining raw material with the new raw material added to the crucible for the next batch cycle.

Also, in respect to claim 4, it would have been obvious to one ordinary skill in the art at the time of the present invention that the electric power supplied to the subsidiary heating means be increased when raw material was introduced because the heat required to form a liquid from a solid (i.e. the heat of fusion) would represent a higher heat requirement than simply maintaining a liquid melt remaining in the crucible. This optimization of heat input would have been obvious to one of ordinary skill in the art at the time of the present invention and would have been achieved with only routine optimization. The examiner notes that the Cz method described by includes adding a solid phase raw material to the crucible and melting that raw material to form a liquid melt. Then, a single crystal is pulled from the melt. (The heat of fusion would have been common knowledge to one of

ordinary skill in the art; See Sears et al., University Physics, 7th Ed., Addison Wesley Pub. Co., pp. 363-365, 1987).

5) However the combined teachings of Kojima 202 and Ito 668 fail to address a crucible with an inner diameter of 28 inches or more.


In an apparatus pertaining to silicon crystal growth Schupp 125 teaches a heating arrangement for a crystal growth furnace, where it is explicitly taught that the inside diameter of the crucible would need to have an inner diameter of 29 inches, which reads on 28 inches or more (Col 11 Lines 11-23).

It would be obvious to one with ordinary skill in the art at the time of the present invention to view the limitation of claim 4 referring to a diameter of 28 inches or more as being a “result effective variable”, as supposed to Kojima 202’s teachings of a 22 inch diameter crucible, and therefore given the analogous art of Schupp 125 with that of Kojima 202 and Ito 668 to incorporate the teachings Schupp 125 with that of the combined teachings of Kojima 202 and Ito 668 because Schupp 125 states that it is crucial for large single crystal growth to have a crucible of a particular size and allow for proper cooling rates to occur.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to G. Nagesh Rao whose telephone number is (571) 272-2946. The examiner can normally be reached on 9AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Yogendra Gupta can be reached on (571)272-1316. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.


YOGENDRA N. GUPTA
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700

GNR